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SPECIAL AIRWORTHINESS INFORMATION BULLETIN

Aircraft Certification Service
Washington, DC

www.faa.gov/certification/aircraft

This is information only. Recommendations aren't mandatory.

Introduction

This Special Airworthiness Information Bulletin (SAIB) provides information to you, owners and operators of **Single-Engine Piston Aircraft that are not equipped with a back-up pneumatic power source** for the air-driven gyros or a back-up electric attitude gyro instrument. This SAIB identifies various FAA publications covering the danger of attempting to fly with only partial panel instruments (that is, turn and slip indicator, altimeter, magnetic compass and airspeed indicator) in the event of primary air pump or pneumatic system failure while flying Instrument Flight Rules (IFR) in Instrument Meteorological Conditions (IMC).

Through this SAIB and as stated in the FAA publication "The Silent Emergency", the FAA recommends "IF YOUR AIRPLANE DOES NOT HAVE A BACK-UP, OR STAND-BY PNEUMATIC SYSTEM, AND IF YOU USE YOUR AIRPLANE FOR IFR FLIGHT, YOU SHOULD INSTALL EITHER A BACK-UP PNEUMATIC POWER SOURCE OR ELECTRICALLY POWERED STAND-BY GYROSCOPIC INSTRUMENTS."¹

Background

Air pump or pneumatic system failures can and do occur without warning. This can be a result of various factors, including but not limited to:

- 1) Normal wear of components.
- 2) Improper installation or maintenance.
- 3) Contamination of the system.
- 4) Premature failure.

Failure of the air pump or any other component of the pneumatic system during IFR flight in IMC can lead to spatial disorientation of the pilot and consequent loss of aircraft control.²

There has been a concern with instrument flight and loss of attitude awareness for at least 50 years. There are two primary situations where loss of attitude awareness may lead to a fatal accident. The first is when a non-instrument-rated pilot inadvertently or intentionally enters IMC, is unable to maintain the attitude of the aircraft, and ultimately enters a spiral dive or increasingly severe oscillations that ultimately lead to aircraft structural failure. The second situation is the one in which instrument-rated pilots in IMC lose their attitude reference through vacuum/pressure system or instrument failure.³

The Air Safety Foundation, in coordination with the FAA Civil Aerospace Medical Institute (CAMI), developed a study to collect baseline aircraft data evaluating pilots' skills in dealing with an unannounced vacuum failure in-flight versus those results obtained in flight simulators. Response to the vacuum-failure

¹ FAA-P-8740-52 "The Silent Emergency" (Pneumatic System Malfunction), AFS-820 2000

² FAA SAIB CE-05-15, November 10, 2004

³ DOT/FAA/AM-02/19 "General Aviation Pilot Performance Following Unannounced In-Flight Loss of Vacuum System and Associated Instruments in Simulated Instrument Meteorological Conditions", October 2002

event required two tasks to be performed. First, the pilot had to recognize that a failure of some kind had occurred and had to correctly diagnose it and, second, the pilot then had to successfully control the aircraft using the flight data remaining.³

Two groups were tested: pilots flying a simple aircraft and pilots flying a complex aircraft with the results summarized as follows:

- 1) Simple Aircraft (Piper Archer PA-28):
The time for the pilot to recognize a failure was between 4.9 and 7.9 minutes. **32% of the pilots became disoriented and did not successfully complete the approach.**
- 2) Complex Aircraft (Beechcraft Bonanza A36):
The time for the pilot to recognize a failure was between 2.6 and 4.6 minutes. **25% of pilots lost control of the aircraft.**

In order to improve safety, the FAA has also published the following documents:

- 1) SAIB CE-01-29R1 on July 10, 2001, to provide a recommended method to preflight check the proper operation of the pneumatic system.⁴
- 2) AC No.: 91-75 on June 25, 2003, to provide a method to substitute an approved attitude indicator for the rate-of-turn indicator mandated by Title 14 of the Code of Federal Regulations (14CFR), Part 91, section 91.205(d)(3).⁵

In addition, the FAA in 1993 changed the regulation: Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplanes, 14CFR 23.1331 “Instruments using a power source”, for newly certificated aircraft to include:

- 3) Each instrument must have an integral visual power annunciator or separate power indicator to indicate when power is not adequate.
- 4) There must be at least two independent sources of power (not driven by the same engine on multiengine airplanes), and a manual or an automatic means to select each power source.

Recommendation

We highly recommend the following:

- If your airplane does not have a back up or stand-by pneumatic system, and if you use your airplane for IFR flight, you should install either a back-up pneumatic power source or electrically powered stand-by gyroscopic instruments.
- Replace your rate-of-turn indicator with an approved attitude indicator, or replace the vacuum powered directional gyro (DG) and the VOR navigational indicator with a Horizontal Situation Indicator (HSI) (w/integral VOR) and install an approved stand-by electrical attitude indicator in the remaining instrument location.
- Any replacement instrument contain a “Flag” to indicate loss of instrument power, whether air or electric.
- Review and follow the Latest Airframe Manufacturer’s and Component Manufacturer’s maintenance, inspection, and replacement instructions.
- Since failed instruments can be misleading, the pilot should keep failed instrument covers available to remove the instrument from the field of view.

³ DOT/FAA/AM-02/19 “General Aviation Pilot Performance Following Unannounced In-Flight Loss of Vacuum System and Associated Instruments in Simulated Instrument Meteorological Conditions”, October 2002

⁴ FAA SAIB CE-01-29R1

⁵ AC No.: 91-75

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Referenced Documents

Documents referenced within this SAIB may be found on the FAA website at the following locations:

¹ FAA-P-8740-52 “The Silent Emergency”
<http://www.faa.gov/fsdo/orl/files/advcir/p874052.txt>

² FAA SAIB CE-05-15
<http://www.faa.gov/certification/aircraft/av-info/ad/saibs/ce-05-15.pdf>

³ DOT/FAA/AM-02/19 “General Aviation Pilot Performance Following Unannounced In-Flight Loss of Vacuum System and Associated Instruments in Simulated Instrument Meteorological Conditions”
<http://www.hf.faa.gov/docs/508/docs/cami/0219.pdf>

⁴ FAA SAIB CE-01-29R1
<http://www.faa.gov/certification/aircraft/av-info/ad/saibs/ce-01-29r1.pdf>

⁵ AC No.: 91-75
<http://www.faa.gov/certification/aircraft/av-info/dst/acreference/090-099.htm>